AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
J	1 of 6

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0004	22-Sep-2003	W16ROE-3210-9068	DACA51-03-B-0023

6. ISSUED BY CODE DACA51

USA ENGINEER DISTRICT, NEW YORK
ATTN: CENAN-CT ROOM 1843
26 FEDERAL PLAZA (DACA51)
NEW YORK NY 10278-0090

7. ADMINISTERED BY (If other than item 6) CODE E3H0400

PPMD-MILITARY
26 FEDERAL PLAZA ROOM 2119
NEW YORK NY 10278

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)

CODE FACILITY CODE

X	9A. AMENDMENT OF SOLICITATION NO. DACA51-03-B-0023
X	9B. DATED (SEE ITEM 11) 21-Aug-2003
	10A. MOD. OF CONTRACT/ORDER NO.
	10B. DATED (SEE ITEM 13)

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [X] is extended, [ ] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

The purpose of this amendment is to (i) incorporate the attached changes to the drawings and specifications, (ii) incorporate submitted questions and answers by the Government and (iii) to change the bid opening date from 24 September 2003, 1500 hours, local time to 25 September 2003, 1400 hours, local time and (iv) to allow receipt of amendment via fax in accordance with FAR Clause 52.214-31. The provision to accept facsimile bids is restricted to this amendment only. Acceptance of the faxed amendments does NOT apply to the DD Form 1442, Solicitation, Offer, and Award. Amendments may be faxed to this office in care of Myrlande Lee, (212) 264-3013.

All other terms remain unchanged as a result of this amendment.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)
	TEL: EMAIL:

15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
_____ (Signature of person authorized to sign)		BY _____ (Signature of Contracting Officer)	22-Sep-2003

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION SF 30 - BLOCK 14 CONTINUATION PAGE

The following have been added by full text:
AMEND 0004

AMENDMENT 0004 TO THE DRAWINGS AND SPECIFICATIONS FOR FY03 C17 Consolidated Flightline Operations Facility, McGUIRE AFB, NEW JERSEY - DACA51-03-B-0023

NOTE: Bidders must acknowledge receipt of this amendment by the date specified in the solicitation (or as amended) by one fo the following methods: in the space provided on the SF1442, by separate letter, or by telegram, or by signing block 15 below. FAILURE TO ACKNOWLEDGE AMENDMENTS BY THE DATE AND TIME SPECIFIED MAY RESULT IN REJECTION OF YOUR BID IN ACCORDANCE WITH THE LATE BID, LATE MODIFICATIONS OF BIDS OR LATE WITHDRAWAL OF BIDS (FAR14.304).

TO OFFERORS

The following changes shall be made to the drawings and specifications.

DRAWINGS

1. The following drawings have been **REVISED** and **REISSUED** with this amendment:

   C-4, SITE PLAN
   C-5, GRADING AND DRAINAGE PLAN
   C-6, UTILTIY PLAN
   C-8, PROFILES
   C-9, PROFILES
   C-11, WATER AND SEWER DETAILS
   C-13. SEWER DETAILS

2. The following DRAWINGS have been **REVISED** but not **REISSUED**:

   A-609, MILLWORK ELEVATIONS AND DETAILS; Details 16A, B and C, **REPLACE** "plastic laminate top" where it appears with "See Finish Schedule A-601."

   A-610, MILLWORK DETAILS, Details 11 and 12, **REPLACE** "SSMA3" where it appears with "SSMA4."

   E-503, ELECTRICAL DETAILS AND SCHEDULES; Detail A4, Duct Bank Section. **REPLACE** the text in notes 1 and 2 to read as follows:
      Note 1: "4" PVC POWER, SERVICE"
      Note 2: "4" PVC SPARE"

C-12, HIGH TEMPERATURE HOT WATER DETAILS (Amend. 3); **DELETE** Detail "End Seal Assembly" from this drawing in its entirety without replacement.

SPECIFICATIONS

1. The following Specifications sections are **REVISED** and **NOT REISSIED** as indicated:

SECTION 12600, THEATER CHAIRS; **DELETE** paragraph 2.2.8 of this section without replacement.

APPENDIX A -MOBILE AISLE STORAGE SYSTEM SPECIFICATION; **ADD** the following to paragraph 2.3; "The bin shelving shall be the 4 post L and T type shelving or equivalent as specified herein."

APPENDIX A -MOBILE AISLE STORAGE SYSTEM SPECIFICATION; **REPLACE** paragraph 2.3.2.2 of this section in its entirety with the following:

"2.3.2.2 Shelf Supports
Shelf supports shall secure the corner of each shelf to the support posts. The shelf supports shall be designed to prevent accidental disengagement of the supports from the post or the shelves under all loading conditions. The shelf supports shall allow shelf spacing to be easily changed without disturbing surrounding shelves and shelving units. Shelf supports shall be capable of being changed with simple hand tools."

2. Specifications sections 02553A –HEAT DISTRIBUTION SYSTES IN CONCRETE TRENCHES is **REPLACED** with SECTION 02552A -PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM, which accompanies this amendment.

BIDDER'S QUESTIONS AND GOVERNMENT REPLY

(Questions that may be of general interest of all bidders/Government and that are not readily answered by the proceeding changes will appear below. These questions may have been paraphrased or altered to represent several questions regarding the same subject and/or clarify and simplify the question(s). Questions and answers are issued to the Offerors/Bidders for information only.)

Q60: Salvaged and relocated communication line. What size duct bank (DB): i.e.; conduit size and quantity)? Is it encased?

A60: 2- 4" conduits. Yes, only encased under pavement. See C-11 reissued this amendment (else, revert to standard bedding detail).

Q61: Is CATV D.B. encased?

A61: Yes, only under pavement. See C-11 reissued this amendment.

Q62: Is voice/data and spare D.B. encased?

A62: Yes, only under pavement. See C-11 reissued this amendment.

Q63: Drawing T-401 – where is the location of maintenance hole #8?

A63: From the northwest of the CFOF, travel perpendicular to the parking lot, and just to the left at the existing sidewalk is the point of connection. It was called hole #8 in a previous contract by others. Note added to C-6 reissued this amendment referencing maintenance hole #8 to clarify.

Q64: Will the CATV utility company be installing the CATV cable and making connection at the pole and at the head end equipment?

A64: Trenching & ductwork to be performed by contractor.

Q65: Is there a contact for McGuire cable provider?

A65: The POC at COM-CAST cable is Jim Parkinson 856-427-4602.

Q66: Drawing E-503, Detail A3 duct bank, where is this used?

A66: Detail is used in Drawing E-201, for the underground primary feed to the service pad mounted transformer.

Q67: Drawing E-503, Detail A4 ductbank, should conduit schedule notes 1 and 2 be reversed to match the one line drawing and conduit feeder schedule or Drawing E-201?

A67: Yes. Reverse the notes as phrased in question.

Q68: Where do we show helical anchors on the drawings?

A68: Helical anchors are shown in Detail 11, Partial Foundation Plan, on drawing S-207 and in related details.

Q69: Millwork on Schedule for rooms 202 and 248 finish schedule shows SSMA4 tops. Section on A-610 shows SSMA tops. Elevation A609 shows plastic laminate tops. Which is correct?

A69: The finish schedule on A-601 is correct. Use SSMA4 for the tops.

Q70: The plant schedule in spec section 02930A differs from the plant schedule on drawing L-100. Which is correct?

A70: The Plant schedule in Specification Section 02930A was deleted per Revision No.1. Drawing L-100 is correct.

Q71: Typical trench cover detail on drawing C12 shows compressed air lines inside of a poured in place concrete trench. Where is this trench required? Cannot locate on any site plan.

A71: Drawing C12 was revised and reissued in amendment #3. This detail has been deleted.

Q72: Are existing site overhead electric being removed by the contractor or the government?

A72: The contractor, see C-3.

Q73: Refer to drawing E2.02; It states 10 HD lights are used in the canopy. Is that 10 lights each canopy or 10 lights total?
A73: Note -2 is tagged for each canopy, therefore, there are 10 type HD light fixtures for each canopy.

Q74: Refer to drawing A-601; Room 131, Life Support Storage, calls for the floor to have LIN01 (Decorative Sheet Flooring) and Concrete. There is no detail or description anywhere else in the Documents that defines where the LIN01 is within this room. What portion of the room gets LIN01?

A74: Provide LIN01 for the entire room 131.

Q75: Refer to drawing A-601; Room 139, Flotation Room, calls for the floor to be both LIN01/CPT1. Please provide a layout or description of where the carpet and decorative floor are use in this room.

A75: CPT1 is on the North side of Column Line H and LIN01 is on the South side.

Q76: Reference is made to specification section 12600, paragraph 2.2.8. Request following information on electronic audio response control: what is the model and specification for the electronic audio response unit? Where is the detail showing the location of the unit below armrest panel (The drawing does not show any armrest to chairs). Is there a wiring layout drawing available?

A76: Electronic Audio Response Control not required. Specification Section 12600-2.2.8 has been deleted per this amendment.

SECTION 00700 - CONTRACT CLAUSES

The following have been added by full text:

52.214-31 FACSIMILE BIDS (DEC 1989)

(a) Definition. "Facsimile bid," as used in this solicitation, means a bid, modification of a bid, or withdrawal of a bid that is transmitted to and received by the Government via electronic equipment that communicates and reproduces both printed and hand-written material.

(b) Bidders may submit facsimile bids as responses to this solicitation. These responses must arrive at the place and by the time, specified in the solicitation.

(c) Facsimile bids that fail to furnish required representations or information or that reject any of the terms, conditions, and provisions of the solicitation may be excluded from consideration.

(d) Facsimile bids must contain the required signatures.

(e) The Government reserves the right to make award solely on the facsimile bid. However, if requested to do so by the Contracting Officer, the apparently successful bidder agrees to promptly submit the complete original signed bid.

(f) Facsimile receiving data and compatibility characteristics are as follows:

(1) Telephone number of receiving facsimile equipment:
212- 264-3013
(2) Compatibility characteristics of receiving facsimile equipment (e.g., make and model number, receiving speed, communications protocol):

(g) If the bidder chooses to transmit a facsimile bid, the Government will not be responsible for any failure attributable to the transmission or receipt of the facsimile bid including, but not limited to, the following:

(1) Receipt of garbled or incomplete bid.

(2) Availability or condition of the receiving facsimile equipment.

(3) Incompatibility between the sending and receiving equipment.

(4) Delay in transmission or receipt of bid.

(5) Failure of the bidder to properly identify the bid.

(6) Illegibility of bid.

(7) Security of bid data.

(End of clause)

(End of Summary of Changes)

SECTION 02552A

PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 300	(2000) Inorganic Zinc Rich Primer

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI MC96.1	(1982) Temperature Measurement Thermocouples

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2000) Carbon Structural Steel
ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 106	(1999el) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 234/A 234M	(2000) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM C 518	(1998)Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASME INTERNATIONAL (ASME)

ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded

ASME B31.1	(1998) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

1.2 DEFINITIONS

The following definitions shall apply to the work.

1.2.1 Pre-engineered System

A complete underground HTHW heat distribution system including all required components such as carrier pipes, and fittings, anchors, pipe supports, insulation, protective casing, and cathodic protection, for the system supplied. The pre-engineered system does not include valve manholes and the piping and equipment inside the valve manholes. The pre-engineered system shall include all piping and components to a point at least 150 mm inside the building and valve manhole walls. The UHDS shall not use any part of the building or valve manhole structure as an anchor point.

1.2.2 Direct-Buried

A system which is buried, without the need for a field-fabricated protective enclosure such as a concrete trench or tunnel.

1.2.3 UHDS Types

1.2.3.1 Drainable-Dryable-Testable (DDT) Direct-Buried System

A factory-fabricated system including an air and water-tight outer protective casing, air space and an insulated carrier pipe. Drains and vents are provided at the end plates of the system (in manholes or buildings). The drains are normally capped but the caps can be removed to drain water which may leak into the air space if there is a failure in the casing or the carrier pipe. The vents allow water vapor to escape and provide a tell-tale sign of leakage.

1.2.4 UHDS Manufacturer

The UHDS manufacturer is the company responsible for the design and manufacture of the pre-engineered system. The UHDS manufacturer directs the installation of the system and has a representative on the jobsite.

1.2.5 UHDS Manufacturer's Representative

The UHDS manufacturer's representative shall be a person who regularly performs the duties specified is certified in writing by the UHDS manufacturer to be technically qualified and experienced in the installation of the system, and shall be authorized by the manufacturer to make and sign the daily reports specified. The UHDS manufacturer's representative shall be under the direct employ and supervision of the UHDS manufacturer.

1.2.6 Corrosion Engineer

Corrosion engineer refers to a person who by knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to

engage in the practice of corrosion control. Such person may be a licensed professional corrosion engineer or certified as being qualified by the National Association of Corrosion Engineers (NACE), if such licensing or certification includes 3 years experience in corrosion control on underground metallic surfaces of the type under this contract. NACE certification shall be technologist, corrosion specialist, or cathodic protection specialist. The corrosion engineer shall make at least 3 visits to the project site. The first of these visits shall include obtaining soil resistivity data, acknowledging the type of pipeline coatings to be used and reporting to the Contractor the type of cathodic protection required. Once the submittals are approved and the materials delivered, the corrosion engineer shall revisit the site to ensure the Contractor understands installation practices and laying out the components. The third visit shall involve testing the installed cathodic protection systems and training applicable personnel on proper maintenance techniques. The corrosion engineer shall supervise, inspect, and test the installation and performance of the cathodic protection system.

1.3 WORK DESCRIPTION

1.3.1 Scope

The work shall include the design and fabrication; furnishing; installing, and testing of a direct buried underground insulated high temperature hot water supply pipe, insulated high temperature hot water return pipe consisting of piping as indicated, cathodic protection system (where required by this specification), together with fittings and appurtenances necessary for a complete and operable system. Gland type end seals will not be permitted. DDT systems with fiberglass casings shall not be provided.

1.3.2 UHDS Design

The UHDS manufacturer shall be responsible for the complete design of the UHDS, the product to be supplied, fabrication, witnessing installation and testing of the system within the design parameters established by the contract drawings and specifications, and in compliance with the detailed design. The complete design of the UHDS shall be sealed by a Professional Engineer in the employ of the UHDS manufacturer.

1.3.3 Contract drawings

The contract drawings accompanying this specification provide information on:

a. The size of carrier pipes, approximate length, and site location of the system.

b. The routing and elevation of the piping along the route.

c. Location and design of manholes.

d. The obstacles that must be avoided along the path.

e. Location of piping anchors (anchors will be no closer than 1 m or further than 1.5 m from entrance to manholes or buildings) at manholes and/or buildings. The UHDS manufacturer shall incorporate anchors as needed for the system.

f. Operating pressure and temperature of system.

1.4 SYSTEM REQUIREMENTS

1.4.1 Cathodic Protection

Cathodic protection shall be provided for systems with coated steel casings in accordance with paragraph Cathodic Protection Installation.

1.4.2 Operating Characteristics

The high temperature hot water supply system shall have an operating temperature of 204 degrees C and an operating pressure of 2069 kPa. The high temperature hot water return system shall have an operating temperature of up to 38 degrees C below supply temperature and an operating pressure of up to 345 kPa below supply pressure.

1.4.3 Rated Characteristics

Thermal expansion calculations shall be computed for the supply and return piping using the following design characteristics and installation temperature. The system design conditions for high temperature hot water supply and/or return shall be a temperature of 204 degrees C and a pressure of 2069 kPa. For calculation purposes, the installation temperature shall not be higher than the ambient temperature at the site: 32 degrees C.

1.5 STANDARD PRODUCTS

The designed system and equipment provided for this project shall be of current production and shall essentially duplicate systems that have been in satisfactory use for at least 5 years prior to bid opening at 3 locations. The systems shall have been operated under pressure, temperature and site characteristics that are equal to or more severe than the operating conditions in this specification and shall have distributed the same medium. The system shall be supported by a service organization that can reach the site after a service call within 2.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heat Distribution System; G.

A complete description of the design and assembly of the system, materials of construction and field installation instructions, not later than 21 days prior to the start of field measurements. Submittal shall also include sufficient system details to show that the specified minimum insulation thickness has been met. A detailed design layout of the system (plan and elevation views) showing size, type, elevations and location of each component to be

used in the system, the design and location of anchors, pipe guides, pipe supports, expansion loops, Z-bends, L-bends, end seals, leak plates, joint locations, pipe and insulation thickness and sizes, types, and movements, connection to manhole and building wall penetrations, and including, if applicable, details of transition point to aboveground or other type systems. Also, if applicable, type and details of the cathodic protection system to be used. Detailed design layout drawings shall be stamped by a registered Professional Engineer.

SD-03 Product Data

Pipe-Stress and System Expansion Calculations; G.

Pipe-stress and system-expansion calculations for each expansion compensation elbow using a finite element computer generated 3 dimensional analysis, not later than 7 days after notice to proceed. Calculations shall demonstrate that pipe stresses from temperature changes are within the allowable requirements in ASME B31.1 and that the anchors and the guides will withstand the resultant forces. Detailed design layout drawings shall include all analysis node points. As a minimum, computer analysis results shall include node stresses, forces, moments and displacements. Calculations shall be stamped by a registered Professional Engineer in the employ of the UHDS manufacturer.

Cathodic Protection Installation; G.

Design life calculations for the cathodic protection system, not later than 7 days after notice to proceed. Calculations shall be stamped by an NACE qualified corrosion engineer.

Thermal Performance Testing; G.

Manufacturer's data sheets on all UHDS components and the instrumentation required for thermal performance testing; and data sheets for all coatings and carrier pipe insulation indicating thicknesses, 7 days after notice to proceed.

Interruption of Existing Service; G.

Schedule of proposed outages and interruptions of existing services, 14 days in advance.

Operational Test; G.

Schedule of testing, 14 days in advance.

Work Plan; G.

A proposed schedule of activities indicating when various items of work and tests are to be carried out and when the representative of the UHDS manufacturer shall be present at job site, not later than 7 days after notice to proceed. A list of characteristics from the UHDS manufacturer shall be submitted indicating what defects or damage will necessitate replacement.

Quality Assurance Plan; G.

Manufacturer's quality assurance plan for fabrication, delivery, storage, installation and testing of system, not later than 7 days after notice to proceed.

Tests; G.

A proposed test procedure and proposed samples of test data sheets for each required test, 30 days prior to the proposed test date. The procedure shall contain a complete description of the proposed test with calibration curves or test results furnished by an independent testing laboratory of each instrument, meter, gauge, and thermometer to be used in the tests. The test shall not commence until the procedure has been approved.

UHDS Manufacturer's Representative Reports; G.

A daily written report from the representative of the UHDS manufacturer, whenever the representative is required to be on the jobsite.

Connecting to Existing Work; G.

Changes required to the UHDS design due to interferences or conflicts, upon realization of interferences or conflicts.

UHDS Manufacturer; G.

Certification stating that the UHDS manufacturer regularly and currently manufactures direct-buried systems, and that the designs of the system and equipment to be provided for this project conform to specification requirements. This certification shall be an original signed by a principal officer of the UHDS manufacturer and shall be submitted at least 2 weeks prior to the start of work.

UHDS Manufacturer's Representative; G.

A letter from the system manufacturer, at least 2 weeks prior to the start of work, listing the experience and training of the manufacturer's representative.

UHDS Design; G.

A Certificate of Satisfactory Operation certifying that at least 3 systems installed by the UHDS manufacturer within the previous 5 years are operating satisfactorily, not later than 7 days after notice to proceed. The certificate shall indicate the location, type of system, size of system, point of contact (POC) including phone number, for information verification. This certificate of satisfactory operation shall be an original signed by a principal officer of the UHDS manufacturer.

Certificate of Compliance; G.

Upon completion of the work, and before final acceptance, a notarized statement signed by a principal officer of both the UHDS

manufacturer and the Contractor, certifying that the system has been installed satisfactorily and in accordance with the contract drawings, specifications, UHDS manufacturer's detailed design layout drawings and with the UHDS manufacturer's recommendations.

Testing Firm Qualifications; G.

A Certificate of Qualification from the independent testing firm or firms, not later than 7 days after notice to proceed, certifying that: weld examination methods and procedures, and the interpretation of radiographic films will be performed in accordance with ASME B31.1; the firm intends to utilize the proper film exposure, techniques, and penetrameter to produce density and geometric sharpness in sufficient clarity to determine presence of defects; and that all radiographic films will be reviewed and interpreted, and reading reports signed, by not less than a Certified American Society for Nondestructive Testing Level III Radiographer.

Welding; G.

Certification of Acceptability of all welds made in the field, upon completion of the project. This certification shall consist of a letter, signed by an official of the independent testing firm or firms examining welds, stating that all provisions of this specification have been complied with, and that all welds inspected radiographically have met the specified acceptability standards.

SD-10 Operation and Maintenance Data

Heat Distribution System; G.

Operation and maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, procedures for recording conduit temperatures biannually, and troubleshooting guides, before completion of work. Manual shall include as-built piping layout of the system including final elevations.

1.7 SITE CLASSIFICATION

TABLE A
SITE CLASSIFICATION DEFINITION
BASED ON KNOWN UNDERGROUND WATER CONDITIONS

Site Classification	General Conditions for Classification
Bad	The water table is expected to be occasionally above the bottom of the system and surface water is expected to accumulate and remain for short periods (or not at all) in the soil surrounding the system OR The water table is expected never to be above the bottom of the system but surface water is expected to accumulate and remain for short periods in the soil surrounding the system.

TABLE B
SITE CLASSIFICATION CRITERIA
BASED ON SUBSURFACE SOIL INVESTIGATION

Site Classif-ication	Water Table Level	Soil Types	Terrain	Precipitation Rates or Irrigation Practices in Area
BAD	Water table Within 1500 mm (5 feet) of bottom of system OR	GW, GP, SW, SP	Any	Any
	No groundwater encountered	GC, SC, SW, CH, OH	Any	Equivalent to 75 mm (3 in) or more in any one month or 500 mm (20 in) or more in one year.

Classification of the site conditions for the UHDS shall be based on ASTM D 2487.

PART 2 PRODUCTS

2.1 FACTORY FABRICATED, DIRECT-BURIED DDT SYSTEMS

2.1.1 High Temperature Hot Water Carrier Pipes

Requirements shall be in accordance with paragraph HEAT DISTRIBUTION PIPING.

2.1.2 Carrier Pipe Insulation

Carrier pipe insulation shall conform to minimum thicknesses and type listed in Tables 1 and 2 as required for temperature specified under paragraph Rated Characteristics.

2.1.3 Insulation Banding and Scrim

Stainless steel bands and clips, at least 13 mm wide, conforming to ASTM A 167 (304 stainless steel), at a maximum spacing of 460 mm shall be used over the scrim to secure the insulation onto the carrier pipe; a minimum of 2 bands shall be used for each 1300 mm section of insulation. Scrim shall be vinyl-coated fiberglass with 18 x 16 mesh (number of filaments per 25 mm) and made of 0.335 mm diameter vinyl-coated fibrous glass yarn.

2.1.4 Casing

Casing shall be smooth-wall steel, electric resistance spiral welded, conforming to ASTM A 134, ASTM A 135, or ASTM A 139 and the values tabulated below. Eccentric connectors shall be provided between casing sections as needed to provide drainage of casing section between manholes and between manholes and buildings.

Casing Diameter (mm)	Minimum Thickness (mm)
150 - 660	6.35
675 - 900	6.35
940 - 1050	6.35
1170	6.35

2.1.5 Casing End Plates, Vents, and Drains

End plates shall be made of ASTM A 36/A 36M steel, minimum thickness 13 mm for conduit pipe sizes above 300 mm and 9.5 mm for conduit pipe sizes 300 mm and less. A 25 mm ASTM A 53/A 53M, Sch 40, galvanized vent riser pipe shall be provided on end plate vent opening. Vent pipe shall extend to top of manhole and terminate 300 mm above grade with a 180 degree bend. A 25 mm drain shall be provided at the bottom and vent at the top. Brass plugs and half coupling, constructed with welded steel and welded to the end plate, shall be furnished; drains shall be plugged; vents shall not be plugged.

2.1.6 Air Space

Continuous 25 mm minimum air space shall be provided between carrier pipe insulation and casing.

2.1.7 Casing Coating

Coating shall be rated by manufacturer for continuous service for at least 25 years at temperatures of 110 degrees C. Coating shall be applied in accordance with the coating manufacturer's instructions, shall be factory inspected for holidays and repaired as necessary.

2.1.7.1 Fusion-Bonded Epoxy

Casing coating shall be fusion-bonded epoxy, minimum thickness 1 mm.

2.1.7.2 Urethane Elastomer

Coating shall be urethane elastomer, minimum thickness 1 mm.

2.1.8 Coating of End Plates and Conduit Extending into Manholes

End plates and conduit extending into manholes shall be coated with a zinc-rich coating conforming to AASHTO M 300 Type IA, except that volatile organic compounds shall not exceed 0.34 kg/L. The zinc-rich coating shall be applied in accordance with the coating manufacturer's requirements including surface preparation. No additional top coat shall be applied.

2.1.9 Carrier Pipe Guides

Carrier pipe guides shall be spaced 3 m on centers maximum, no more than 1.5 m from pipe ends, with a minimum of 3 guides per elbow section. Guides shall be designed to allow thermal expansion without damage, to provide proper pipe guiding, and to allow horizontal movement in 2 directions as required at expansion loops and bends. Design of supports shall permit flow of water through the support. Pipe insulation shall extend through the pipe guides and be protected by steel sleeves. Design of guides shall negate metal-to-metal contact between the casing and the carrier pipe. Insulation or non-metallic material used to ensure no metal-to-metal contact shall not be compressed by the weight of the carrier pipe when full of water.

2.1.10 Anchor Plates

Anchor plate shall be ASTM A 36/A 36M steel, welded to carrier pipe and casing, 13 mm minimum thickness, with passages for air flow and water drainage thru the annular air space in the system. Exterior surface of the anchor plate shall be coated with the same coating material as the casing.

2.1.11 Field Connection of Casing Sections

Field connection of casing shall be made using a compatible steel section, welded to casing sections, coated on all surfaces with UHDS manufacturer's coating field repair compound, and covered with a 1.3 mm minimum thickness polyethylene shrink sleeve designed for a service temperature exceeding 80 degrees C.

2.1.12 Manufacturer's Identification

Embossed brass or stainless steel tag, hung by brass or stainless steel chain at each end of each conduit or insulated piping in the manholes and buildings, shall be provided. The tag shall identify UHDS manufacturer's name, date of installation, Government contract, and manufacturer's project number.

2.2 FACTORY FABRICATED, DIRECT-BURIED SYSTEM

2.2.1 High Temperature Hot Water Carrier Pipes

Carrier piping shall be steel, schedule 80, ASTM A53 or ASTM A106. Fittings shall be qrought steel, Schedule 80, ASTM A234, butt welded.

2.2.2 Carrier Pipe Insulation

Insulation shall conform to minimum thicknesses and type listed for in Table 1 as required for temperature in carrier pipe. Insulation shall consist of an inner layer of high temperature calcium silicate and an outer layer of polyurethane foam.

2.2.2.1 Calcium Silicate

The calcium silicate insulation shall be a hydrous material satisfactory for temperatures to 650 degrees C. Calcium silicate insulation shall conform to ASTM C 533. The physical properties shall be as follows:

a. Density (dry): 208 kg/cubic meter (minimum). Compressive Strength to produce 5% compression: 1723 kPa (For 37 mm thick sample).

b. Maximum linear shrinkage after 24 hour soaking period at 650 degrees C: 1.1%

c. Maximum Thermal Conductivity k: k = W/(meter*K). Where k varies with temperature as shown:

Mean Temp	100	200	300	400
k	0.38	0.41	0.44	0.48
k(metric)	0.04	0.04	0.04	0.04

2.2.2.2 Insulation Concentricity

Carrier pipe shall be concentric in relation to the casing pipe. The allowable maximum deviation from center line of the carrier pipe shall be plus or minus 6 mm at the casing center point and plus or minus 1.5 mm at the end seals.

2.2.2.3 Insulated Fittings

Fittings shall be pre-insulated by manufacturer using the same insulation thickness and casing as the straight sections.

2.2.2.4 Coupling Insulation

The insulation thickness shall be equal to the carrier pipe insulation. The coupling shall be encased in the same casing as the pipe.

2.2.3 Manufacturer's Identification

The Contractor shall provide an embossed brass tag hung by a brass chain, or a stainless steel tag hung by a stainless steel chain, at each end of each casing or insulated piping in the manholes and buildings. The tags shall identify UHDS manufacturer's name and date of installation.

2.2.4 End Seals

Each preinsulated section of piping shall completely seal the insulation, providing a permanent water and vapor seal at each end. Preinsulated factory fabricated sections of piping modified in the field shall be provided with an end seal which is equivalent to the end seals furnished with the preinsulated section of piping. Tests shall be conducted by the UHDS manufacturer to demonstrate that casings, couplings and end seals are capable of resisting penetration of water into the casing and insulation under rated conditions. The tests shall be performed on each type of pre-fabricated system to be furnished, and the test results shall be verified by an independent testing laboratory.

2.2.5 Assembly Test of Systems for High Temperature Water Service

The tests shall demonstrate that the system will operate successfully for 25 years under typical operating conditions. The tests shall be conducted in both a dry and wet environment. The WSL system shall be as described in the manufacturer's brochure. The testing program described below shall be

conducted at the expense of the WSL system manufacturer. Tests shall be witnessed and verified by an independent testing laboratory. The entire pre-insulated test section shall be hydrostatically tested, with water, to 2600 kPa (1.5 times the rated pressure) before and after temperature cycling. The tests shall be conducted in a dry environment for 60 cycles followed by a test in a wet environment for 60 cycles for a total of 120 cycles. The test in the wet environment demonstrates resistance to ground water infiltration. All tests shall be conducted on 1 test section and all testing shall be completed in 1 time period (approximately 6 weeks) and the 120 testing cycles shall be continuous except for weekend time periods.

2.2.5.1 Apparatus

A curved bottom test tank at least 3.7 m long, 0.8 m wide, 0.8 m deep shall be used. The tank shall be fitted with a gasketed and bolted cover to pressurize the tank to 60 kPa. The tank shall have a drain at the lowest point and a vent at the highest point. Manhole entrance sleeves (i.e. wall sleeves through the ends of the tank to simulate manhole entries in actual field conditions) shall be centrally located on each end of the tank. Auxiliary equipment shall include: Steam supply with sufficient capacity to satisfy testing requirements, makeup water tank and pump, and a means for continuously recording temperatures and pressures at needed locations. Thermocouples shall be used to record temperatures and pressure at the following points:

a. Carrier pipe at tank inlet (in thermowell).

b. Casing at mid-point in pipe length (on casing).

c. Casing at anchor point (above FRP overwrap on plate).

d. Casing at field joint (repair, on casing).

e. Casing at coupling mid-point (on casing).

f. End seal flange at coupling (on elastomer).

g. Outer edge of new end plate (at steel plate and FRP wrap).

h. Carrier pipe at specimen outlet end (in thermowell).

i. Interface of calcium-silicate and polyurethane insulations.

j. Interface of calcium-silicate and polyurethane insulations.

k. Carrier pipe internal pressure, at inlet to test specimen.

l. Pressure at test tank.

Surface thermocouples shall be epoxied to the surface of the casing. The calibration of the thermocouples shall be checked and recorded prior to installation and the recorder shall record within 0.06 degree C resolution.

2.2.5.2 Test Section

A 100 mm steel carrier pipe test section consisting of 8 m of pre-insulated pipe meeting specified materials and design requirements shall be

provided. Approximately 3.7 m of the test section shall be encased within the tank as described below. The test section within the tank shall consist of an expansion coupling, field repair joint, anchor plate, anchor block and end seals. The test section shall be installed (as directed) on at least 280 mm of firmly tamped sand. Sand shall surround the casing, and top surface of the sand shall not be any farther than 100 mm from the top of the tank. The test section shall be anchored to the tank wall at one end and the building floor at the other end on the portion of the pipe external to the tank. The expansion coupling shall be misaligned by 1.5 degrees in the horizontal plane. Sand (118 mL) shall be introduced into the carrier pipe and disbursed throughout the test loop at startup.

2.2.5.3 Resistance to Water Damage and Joint Leakage

This test shall simulate the operation of the system to assure the system will provide successful service life thru its expected life span. The system shall be tested in steam service by cycling for an extended period of time, as described below. System performance shall be deemed successful if there is no joint leakage, deformation of the casing, deterioration of the end seals, or any other deleterious effects.

a. The piping system shall be subjected to 60 cycles of steam introduced into the system while at ambient temperature 38 degrees C up to a temperature of 207 degrees C (as measured at the core pipe at the tank inlet and tank outlet) and back to ambient temperature. The system shall be held at 207 degrees C minimum for a minimum of 30 minutes, each cycle. This cycling shall continue for 60 cycles in dry sand followed by 60 cycles in a saturated environment. The reduction in temperature to 38 degrees C shall occur naturally with no artificial means of cooling used.

b. Results shall conform to paragraph Criteria for Satisfactory Results and Reporting.

2.2.5.4 Resistance to Mechanical or Structural Damage

This test shall simulate loads induced by truck traffic over pipe, which may occur under actual operating conditions. This test shall be conducted commencing with the 41st cycle of the Resistance to Water Damage and Joint Leakage test and continue through the 60th cycle. Other aspects of the Resistance to Water Damage and Joint Leakage test shall continue simultaneously with this test.

a. Apparatus: Same as for apparatus used in Resistance to Ground Water Infiltration test with the addition of a 96 kPa loading device. A hydraulic jack shall be used to apply the test pressure against a 500 x 500 mm plate bearing on the sand directly over the coupling in the tank.

b. Procedure: A steady and constant vertical load of 96 kPa shall be applied to the plate for 14 days during the test. The test section shall be installed as in the Resistance to Ground Water Infiltration test. During the 14 day loading period, steam shall be circulated through the carrier pipe alternately at ambient and 207 degrees C as in earlier test.

c. Results: Requirements shall be in accordance with paragraph Criteria for Satisfactory Results and Reporting.

2.2.5.5 Resistance to Ground Water Infiltration

This test shall be the wet environment test conducted during the second 3 weeks (61st to 120th cycles) of the test period to show that the WSL system will resist the penetration of ground water into the system.

a. Apparatus: Same as for basic apparatus used in Resistance to Water Damage and Joint Leakage phase test, plus the following:

(1) One 200 L water reservoir with a 0 to 206 kPa pressure gauge and compressed air connection.

(2) Provisions to introduce pressurized red dye into the curved bottom test tank. The water/dye solution shall be mixed to a concentration in accordance with the dye manufacturer's recommendation for maximum detectability.

(3) One pressure tank with 0 to 206 kPa static pressure gauge.

b. Procedure: This phase shall start on the 61st cycle and continue until the 120th cycle. The test section of pipe shall be the same test segment used in the previous tests. The tank cover shall be bolted in place and the Resistance to Ground Water Infiltration test shall begin. The water/dye source shall be attached to the fill fitting and a surge tank shall be attached to the vent with a tee fitting. The pressure tank shall have a 0 to 206 kPa static pressure gauge attached. The other branch of the tee fitting shall employ a shut-off valve. With the shut-off valve open, the water/dye mixture shall be admitted into the tank through the fill fitting until the tank is full and water/dye runs freely from the open valve. The valve shall be closed and the filling shall continue until the pressure reaches 60 kPa. The tank pressure shall be maintained throughout the test period. Steam shall be circulated through the carrier pipe and cycled from ambient to 207 degrees C as in the previous test. At the end of the test, the pressure shall be relieved by opening the vent valve and the water/dye shall be drained from the tank through the drain fitting.

c. Results: Requirements shall be in accordance with paragraph Criteria for Satisfactory Results and Reporting.

2.2.5.6 Criteria for Satisfactory Results and Reporting

a. Reporting: Logs of times and temperature shall be recorded to assure compliance with test requirements and procedures. Complete photographic documentation of the construction and operation of the test facility, as well as the piping system components before and after testing, shall be produced. Data shall be analyzed to assure complete compliance with test objectives.

b. Drawing: A drawing showing details of the test apparatus and test specimen shall be provided.

c. For the Resistance to Water Damage and Joint Leakage test: Joints and end seals shall be removed for examination, immediately upon completion of all test cycles. Successful results shall show that steam has not leaked out of the carrier pipe and that the components show no signs of deterioration.

d. For the Resistance to Mechanical or Structural Damage test: The loading shall not have been sufficient to allow the casing to be damaged or deformed enough to impair functioning of the system. The casing shall not be ruptured or deformed more than 25 mm in any direction. Casing sections with pipe anchors shall not fail.

e. For the Resistance to Ground Water Infiltration test: Determination shall be made to ascertain whether or not the water/dye solution has entered the insulation. This shall be observed by removing and inspecting all joints and seals for dye penetration at the end of the test. Results will be deemed successful if no solution is evident in the insulation.

f. Evidence of Test Results: After completion of all tests, the test apparatus shall be dismantled for visual inspection of all critical components subjected to the heat cycling, water infiltration and loading tests. All parts will be examined thoroughly for any detrimental affects. Examinations identified shall be conducted. Log sheets, test data and color photographs shall be kept on file and made available as required to document and substantiate compliance to the test requirements.

g. Report: A report from the independent testing agency shall be submitted. The report shall include the laboratory analysis of the condition of the test section and shall attest that the testing conditions were followed.

2.3 PIPE INSULATION TYPE AND MINIMUM THICKNESS

All types of specified insulation shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Materials containing asbestos will not be permitted. The minimum thickness of insulation for the heat distribution system shall be in accordance with Tables 1 and 2 in which the insulations listed have passed the 96 hour boiling water test.

TABLE 1
MINIMUM PIPE INSULATION THICKNESS (mm)

For Steam (100 to 2.800 kPa (gage)) and High Temperature Hot Water Supply and Return (120 to 230 degrees C).

	INSULATIONS For Drainable/Dryable Systems		
Nominal Pipe Diameter (mm)	Paroc	Epitherm Delta	Kaylo-10 Thermo-12 Super Caltemp
25	50	63	100
40	50	63	100
50	63	85	110
65	63	85	110
80	75	100	125
100	75	100	125

125	75	100	125
150	85	110	135
200	85	110	135
250	100	125	150
300	100	125	150
350	100	125	150
400	100	125	150
450	100	125	150

2.4 HEAT DISTRIBUTION PIPING

2.4.1 High Temperature Hot Water Pipe

Pipe material shall be steel; seamless ASTM A 53/A 53M, Grade B or ASTM A 106, Grade B; 80. ASTM A 53/A 53M, Type F furnace butt welded pipe will not be allowed. Joints will not be allowed in the factory fabricated straight section of the carrier pipe. Factory fabricated piping sections, as part of an expansion loop or bend, shall have all welded joints 100% radiographically inspected in accordance with ASME B31.1. Radiographs shall be reviewed and interpreted by a Certified American Society for Nondestructive Testing (ASNT) Level III radiographer, employed by the testing firm, who shall sign the reading report.

2.4.1.1 Joints

Joints shall be butt-weld except socket-weld joints will be permitted for pipe sizes 50 mm and smaller. Dye penetrant may be used in place of 100% radiographic inspection for pipe sizes 50 mm and below. Location and elevation of all field joints shall be indicated on detailed design layout drawings. Split-ring welding rings may be used.

2.4.2 Fittings

Welds in factory fittings shall be radiographically inspected. Radiographs shall be reviewed and interpreted by a Certified ASNT Level III radiographer, employed by the testing firm, who shall sign the reading report. The Contracting Officer may review all inspection records, and if any welds inspected are found unacceptable in accordance with ASME B31.1, the fitting shall be removed, replaced, and radiographically reexamined at no cost to the Government.

2.4.2.1 Butt-Welded

Fittings shall be steel; ASTM A 234/A 234M, Grade B or ASME B16.9, same schedule as adjoining pipe. Elbows shall be long radius unless otherwise indicated. Tees shall be full size or reducing as required, having interior surfaces smoothly contoured. Split-ring welding rings may be used.

2.4.2.2 Socket-Welded

Fittings shall be forged steel ASME B16.11; 13,800 kPa class shall be used for pipe sizes 50 mm and below. Dye penetrant inspection may be used in lieu of radiographic inspection of welded fittings for pipe sizes 50 mm and below.

2.5 EXPANSION LOOPS AND BENDS

Stresses shall be less than the maximum allowable stress from the Power Piping Code (ASME B31.1). Detailed design layout drawings and stress and anchor force calculations shall be provided for all loops and bends. Locations of all anchors, guides and supports shall be shown. The calculations shall be based on design characteristics (pressures and temperatures) specified for both the supply and return lines.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Interruption of Existing Service

The Contractor shall arrange, phase and perform work and provide temporary facilities, materials, equipment, and connections to utilities, to ensure adequate heat distribution service for existing installations at all times. Only necessary interruptions required for making connections will be permitted, and only at times when approval is obtained from the Contracting Officer.

3.1.2 Grading

Unless otherwise shown on the contract drawings or the detailed design layout drawings, steam/condensate and high temperature hot water supply/return lines shall be graded uniformly downward not less than 40 mm in 10 meters to the lower point of entry between manholes and/or building entries.

3.1.3 Connecting to Existing Work

New work shall be connected to existing work in a neat and workmanlike manner. Connections shall be made only in manholes. Where an existing structure must be cut or existing utilities interfere, such obstructions shall be bypassed, removed, replaced or relocated, restored and repaired. Any changes required to the UHDS design as a result of interferences or conflicts shall be approved by the UHDS designer and the Contracting Officer. Work disturbed or damaged shall be replaced to its prior condition.

3.1.4 Coordination

The location of all items of equipment and work of all trades shall be coordinated. Operability and maintainability of the equipment and systems shall be maintained.

3.1.5 Variations

Any variations from the approved, detailed design layout drawings shall be submitted to the Contracting Officer for approval. Variations shall be signed and sealed by the UHDS manufacturers' professional engineer responsible for the complete design of the UHDS.

3.1.6 Storage and Handling During Installation

Equipment and material placed on the job shall remain in the custody of the Contractor until final acceptance whether or not the Contractor has been reimbursed for the equipment and material by the Government. The Contractor shall be solely responsible for the protection of the equipment and material against damage from any source while stored or during installation. Materials shall be protected against damage from UV light, and entry of water and mud, by installing watertight protection on open ends at all times. Sections of the casing or carrier piping found to have been subjected to full or partial submergence in water (which would allow the insulation to become wet) shall be immediately replaced. Materials awaiting installation shall be covered to protect from UV degradation.

3.2 DEMOLITION

3.2.1 Demolition Procedures

Work shall be performed in accordance with requirements for phasing. Pipe, valves, fittings, insulation, and hangers, including the connection to the structure and any fastenings, shall be removed. Openings in manhole or building walls shall be sealed after removal of piping. Material and equipment removed shall become the property of the Contractor and shall be removed from Government property within 1 week and shall not be stored in operating areas. Flame cutting shall be performed with adequate fire protection facilities available as required by safety codes and Contracting Officer.

3.3 PIPE, PIPING JOINTS AND FITTINGS

3.3.1 Joint Preparation

Pipe and fittings shall be cleaned inside and outside before and after assembly. Dirt, scale, and other foreign matter shall be removed from inside the piping by use of a pipe swab or pipe pig before connecting pipe sections, valves, equipment or fittings. Eccentric connectors shall be used as needed between casing sections to provide drainage of casing section between manholes and between manholes and buildings.

3.3.2 Direction Changes

Changes in direction shall be made with factory-built reinforced fittings. Field-fabricated fittings and miters will not be permitted.

3.4 WELDING

The Contractor shall be responsible for welding quality and shall:

a. Conduct tests of the welding procedures used in the work, determine the suitability of the procedures used, determine that the welds made will meet the required tests, and determine that the welding operators have the ability to make sound welds under standard conditions.

b. Comply with ASME B31.1.

c. Perform all welding operations required for construction and installation of the heat distribution system.

3.4.1 Qualification of Welders

Rules of procedure for qualification of all welders and general requirements for fusion welding shall conform with the applicable portions of ASME B31.1, and as outlined below.

3.4.2 Examining Welders

The Contractor shall examine each welder to determine the ability of the welder to meet the required qualifications. Welders shall be tested for welds in all positions, including welds with the axis horizontal (not rolled) and with the axis vertical. Each welder shall:

a. Weld only in positions in which they have qualified.

b. Identify welds with the specific code marking signifying name and number assigned.

3.4.3 Examination Results

The Contractor shall furnish a list of welder's names and corresponding code markings. Welders which fail to meet the prescribed welding qualifications shall be retested. Welders who fail the second test shall be disqualified for work on this project.

3.4.4 Beveling

Field and shop bevels shall be done by mechanical means or by flame cutting. Where beveling is done by flame cutting, surfaces shall be thoroughly cleaned of scale and oxidation just prior to welding.

3.4.5 Alignment

Split welding rings shall be used for field joints on carrier pipes above 50 mm to assure proper alignment, complete weld penetration, and prevention of weld spatter reaching the interior of the pipe. Field joints 50 mm and smaller shall be made with welding sockets.

3.4.6 Erection

Piping shall not be split, bent, flattened, or otherwise damaged before, during, or after installation. Where the pipe temperature falls to 0 degrees C or lower, the pipe shall be heated to approximately 38 degrees C for a distance of 300 mm on each side of the weld before welding, and the weld shall be finished before the pipe cools to 0 degrees C.

3.4.7 Defective Welds

Defective welds shall be replaced and reinspected in accordance with ASME B31.1. Repairing defective welds by adding weld material over the defect or by peening will not be permitted. Welders responsible for defective welds shall be tested for qualification.

3.4.8 Electrodes

Electrodes shall be stored in a dry, heated area, and shall be kept free of moisture and dampness during fabrication operations. Electrodes that have lost part of their coating shall not be used.

3.4.9 Radiographic Testing

An approved independent testing firm regularly engaged in radiographic testing shall perform radiographic examination of 100% of the field welds in the carrier piping of direct-buried systems in accordance with ASME B31.1. The following shall be furnished: a set of films showing each weld inspected, a reading report evaluating the quality of each weld, and a location plan showing the physical location where each weld is to be found in the completed project, prior to installing casing field joints, backfilling and hydrostatic testing. All radiographs shall be reviewed and interpreted by a Certified American Society for Nondestructive Testing Level III radiographer, employed by the testing firm, who shall sign the reading report. The Contracting Officer may review all inspection records, and if any welds inspected are found unacceptable they shall be removed, rewelded, and radiographically reexamined at no cost to the Government.

3.5 HEAT DISTRIBUTION SYSTEM INSTALLATION

The UHDS manufacturer's representative shall oversee the delivery, storage, installation and testing of the system. Work shall be in accordance with the requirements specified and with the printed instructions of the manufacturer. These specifications shall take precedence over the printed instructions if conflicts arise. Printed instructions shall be submitted to the Contracting Officer prior to system installation.

3.5.1 Verification of Final Elevations

Prior to covering the top of the casing with backfill material, but after all temporary supports have been removed and initial backfilling of the conduit system has been accomplished, the Contractor shall measure and record the elevation of the top of the casing in the trench. Elevations shall be taken at every completed field joint, 1/3 points along each pipe section and top of elbows. These measurements shall be checked against the contract drawings and shall confirm that the conduit system has been installed to the elevations shown on the contract drawings. Slope shall be uniform to within 0.1%. These measurements shall be recorded by the Contractor, included in the UHDS manufacturer's representative daily report, and given to the Contracting Officer prior to covering the casing with backfill material.

3.5.2 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be performed as required by the UHDS manufacturer's design and as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Pipe shall lay on a 305 mm minimum sand bed and shall be backfilled with sand on all sides to a minimum of 150 mm as measured from outside of casing. Foundation for system shall be firm and stable. Foundation and backfill shall be free from rocks or substances which could damage the system coating. Concrete anchor and thrust blocks shall be installed in undisturbed earth. Backfilling shall not commence until system has been satisfactorily pressure tested (both hydrostatic test of carrier and air test of casing). Minimum depth of

burial to the top of the casing shall be 1 meter. Maximum depth of burial to the top of the casing shall be 3 meters.

3.5.3 UHDS Manufacturer's Representative Responsibilities

The UHDS Manufacturer's representative shall be present at the job site and witness when the following types of work are being performed:

a. Inspection and unloading.

b. Inspection of trench prior to commencing installation of system.

c. Inspection of concrete anchors and thrust blocks.

d. Pneumatic and Hydrostatic testing.

e. Field joint closure work.

f. Air test of casing.

g. Holiday test of conduit coating.

h. Repair of any coating.

i. Installation of cathodic protection system.

j. Initial backfill up to 250 mm above the top of the casing.

k. Verification of final elevations. Elevation readings shall be witnessed and recorded.

l. Testing of cathodic protection system.

m. Operational tests.

The UHDS manufacturer's representative shall notify the Contractor immediately of any problems. The UHDS manufacturer's representative shall notify the Contracting Officer of problems requiring immediate action; otherwise, the daily reports shall note any problems encountered and indicate the corrective actions taken.

3.5.4 UHDS Manufacturer's Representative Reports

The UHDS manufacturer's representative shall: prepare and sign a written daily report; present the original daily report to the Contracting Officer no later than one working day after it is prepared; and forward 1 copy to the manufacturer's main office. The report shall state whether or not the condition and quality of the materials used and the delivery, storage, installation and testing of the system are in accordance with the drawings, specifications, and manufacturer's printed instructions and are satisfactory in all respects. When any work connected with the installation is unsatisfactory, the report shall state what corrective action has been taken or shall contain the UHDS manufacturer's recommendations for corrective action. The report shall identify any condition that could result in an unsatisfactory installation, including such items as open conduit ends left in the trench overnight and improper manhole entries. The daily reports shall be reviewed, signed and sealed, on a weekly basis, by the registered

engineer responsible for the system design. Signed and sealed copies of the daily reports shall be submitted with the payment request. Requests for payment will be denied if the weekly review is not accomplished. Upon completion of the work and before final acceptance, a notarized Certificate of Compliance, signed by a principal officer of both the manufacturing and the contracting firms, stating that the installation is satisfactory and in accordance with drawings, specifications, and manufacturer's instructions shall be delivered to the Contracting Officer. The UHDS manufacturer shall retain a copy of all daily reports and the Certificate of Compliance for 5 years after final acceptance of the system by the Government.

3.5.5 Protection

Casing coating shall be protected from damage during unloading, storage, rigging and installation. Casing and carrier pipe ends shall be protected from water intrusion during unloading, storage, rigging and installation. Piping and accessories shall be protected from damage due to exposure to UV light.

3.5.6 Defective Material

The UHDS manufacturer's representative shall take prompt action to remove from the site all damaged or defective material, subject to rejection in accordance with the quality assurance provisions included in the manufacturer's submittals and printed instructions, and shall order prompt replacement of such material.

3.5.7 Cathodic Protection Installation

Provide cathodic protection for all steel casing systems and all buried exposed metal. Assume that 25 percent of the exterior of the UHDS is exposed metal. Cathodic protection systems shall have a minimum design life of 25 years. Dielectric pipe flanges and waterways, and isolation devices shall be provided at all points necessary. Test stations at grade shall be provided on each section of the piping system. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match the connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

3.6 TESTS

Leak-tightness of all piping systems shall be demonstrated by performing pressure tests (hydrostatic, pneumatic) and operational tests. Heat distribution system shall be pressure tested in conformance with specified requirements and printed instructions for the system supplied; tests shall include carrier piping and casing. The carrier pipe shall be hydrostatically tested. Casings of DDT systems shall be pneumatically tested. Casing and end seals of WSL system shall be tested for intrusion of water into the casing and insulation.

3.6.1 Holiday Testing of Direct-buried System Steel Casings

Entire exterior surface of the casing, including the bottom exterior surface, shall be tested for faults in coating after installation in trench,

prior to backfilling, using test method and voltage recommended by coating manufacturer. If any holidays are found, they shall be repaired and the coating retested. System shall not be backfilled until all holidays are eliminated.

3.6.2 Pneumatic, Hydrostatic and Operational Tests

Before conducting heat distribution system tests, lines shall be flushed with high pressure water until discharge shows no foreign matter the Contracting Officer, and after examining the discharge, stops the flush.

3.6.2.1 Pneumatic Test

The casing of the systems shall be pneumatically tested after welding and before field coating using air as the test medium. The test pressure shall be 103 kPa. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. The test shall continue for 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the casing has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T(1)P(2) = T(2)P(1)$, in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial (1) and final (2) readings. Pressure shall be measured with a pressure gauge conforming to ASME B40.1. A throttling type needle valve or a pulsation dampener and shutoff valve may be included. The diameter of the face shall be at least 114 mm with a measurable range of 0 to 103 kPa and graduations of at least 0.5 kPa. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested while under test pressure by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain proper safety precautions for air pressure testing at all times during the tests.

3.6.2.2 Hydrostatic Test

Carrier piping shall be tested hydrostatically before insulation is applied at field joints and shall be proved tight at a pressure 1.5 times the heat distribution supply pressure for 2 hours. There shall be no indication of reduction of pressure during the test. Pressure shall be measured with a device calibrated to be read in increments not greater than 1 kPa.

3.6.2.3 Operational Test

Prior to acceptance of the installation, Contractor shall subject system to operating tests simulating actual operating conditions to demonstrate satisfactory functional and operating efficiency. These operating tests shall cover a period of not less than 6 hours for each portion of system tested. Contractor shall submit for approval a schedule of the tests to be

performed. The contractor shall provide calibrated instruments, equipment, facilities and labor, at no additional cost to the Government. When failures occur, problems shall be repaired and test repeated.

3.6.3 Deficiencies

Deficiencies discovered shall be corrected at the Contractor's expense. Major deficiencies, or failure to correct deficiencies, may be considered cause for rejecting the entire installation.

3.7 VALVE MANHOLES

Valve manholes, piping, and equipment in valve manholes shall be in accordance with the contract drawings.

3.8 BURIED UTILITY WARNING AND IDENTIFICATION

3.8.1 Plastic Marking Tape

Polyethylene plastic tape manufactured specifically for warning and identifying buried utility lines shall be supplied and installed. Tape shall be buried above the pipe during the trench backfilling operation and shall be buried approximately 300 mm below grade. Tape shall be . Tape shall be acid- and alkali-resistant and shall have a minimum strength of 12 MPa lengthwise and 10.3 MPa crosswise with an elongation factor of 350 percent. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 1 m deep. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. The tape shall be of a type specifically manufactured for marking and locating metallic underground utilities. Tape shall be 150 mm wide and printed with a caution and identification of the piping system over the entire tape length. Tape shall be yellow with bold black letters. Tape color and lettering shall be unaffected by moisture and other substances contained in the backfill material.

3.9 THERMAL PERFORMANCE TESTING

The equipment and procedures specified shall be used to ensure acceptable thermal performance of the installed system. The test results shall be submitted for approval. All materials and procedures described for this test shall be included as deliverables of the construction contract for the system, unless otherwise noted.

3.9.1 Equipment

3.9.1.1 Casing Temperature Measurement

Before backfilling, and after field joint closures have been welded to the casing and the coating has been applied and cured, temperature sensors shall be attached to the exterior of every other field joint closure. The sensors shall be attached with epoxy suitable for use at 260 degrees C. A sensor shall be adhered with epoxy to the coated casing near the midpoint of every other pipe section between field joints. The sensor shall not be located closer than 1.5 m from any guide in the interior of the casing. After the sensors have been adhered to the casing, 2 complete wraps of duct tape shall be used to secure and protect the sensor. The radial position of the

sensors shall be located 45 degrees from the top center of the casing, at either the 1:30 or 10:30 position, away from the adjacent heat distribution system pipe if present. All sensors shall be type T thermocouples in accordance with ANSI MC96.1 copper constantan 20 gauge thermocouples, made from special limits grade thermocouple wire, 0.5 degrees C or 0.4 percent maximum error, with each conductor insulated and an overall jacket on both conductors. Insulation on the thermocouple wires shall be suitable for service at 260 degrees C. The thermocouple wire between sensor location and termination point shall be continuous with no splicing or other connections. Each sensor shall be shown with a special symbol on the detailed design layout drawings and shall be identified by a number and/or letter code, starting from the upstream manhole.

3.9.1.2 Carrier Pipe Temperature Measurement

Carrier pipe temperature shall be measured within the manhole where the panel box is located. Carrier pipe temperature shall be measured by a sensor adhered with epoxy directly to the exterior of the carrier pipe. All sensors shall be type T thermocouples in accordance with ANSI MC96.1 copper constantan 20 gauge thermocouples, made from special limits grade thermocouple wire, 0.5 degrees C or 0.4 percent maximum error, with each conductor insulated and an overall jacket on both conductors. Insulation on the thermocouple wires shall be suitable for service at 260 degrees C. The thermocouple wire between sensor location and termination point shall be continuous with no splicing or other connections. The location of this sensor shall be at either the 1:30 or 10:30 position. At the location of the sensor, the carrier pipe shall be insulated with calcium silicate insulation at least 125 mm thick. This insulation shall extend at least 150 mm on each side of the actual sensor location and shall be clad with an aluminum jacket.

3.9.1.3 Terminals

The wires from each casing or carrier pipe temperature sensor shall be extended into the nearest manhole and terminated in a panel box. The panel box shall be a NEMA Type 4 waterproof enclosure, of suitable size, mounted near the top of the manhole at a location near the manhole entrance, accessible without entrance into the manhole, where possible. The termination of the sensor wires shall be with an approved connector of type OMEGA Miniature Jack Panel (MJP-*-*-T). The thermocouple jack panel shall be mounted to the back plate of the panel box. The temperature sensors shall be labeled at their termination within the panel box; a drawing showing the location of each temperature sensor shall be laminated and attached to the inside of the panel box. All temperature sensors shall be verified as operational by an independent laboratory, hired by the Contractor, after backfilling is complete but before the system is accepted.

3.9.2 Thermal Performance Test

After the system construction is complete, including backfilling, and the system has reached operating condition for at least 30 days, all of the temperature sensors shall be read by an independent laboratory with experience and equipment appropriate for the sensors used. The temperature shall be recorded for each sensor. The temperatures shall be tabulated and submitted in accordance with specified requirements. If temperatures exceed values in Table 3, that portion shall be repaired and temperatures again measured and recorded.

TABLE 3

Carrier Pipe Temperat. TP (degrees C)	Carrier Pipe Temperat. TP (degrees F)	Acceptable Casing Temperature TC (degrees C)	Acceptable Casing Temperature TC (degrees F)
121	250	43	110
135	275	47	116
149	300	50	123
163	325	54	129
177	350	58	136
204	400	65	149

The following equations were used to calculate the above values:

T@ <(0.261) X (TP) + 44.3 (for English units)
T, <(0.261) X (TP) + 11.5 (for Metric units)

For carrier pipe temperatures between those given in Table 3, the maximum acceptable casing temperature may be either interpolated from the values in Table 3 or calculated using the equations above.

-- End Of Section --